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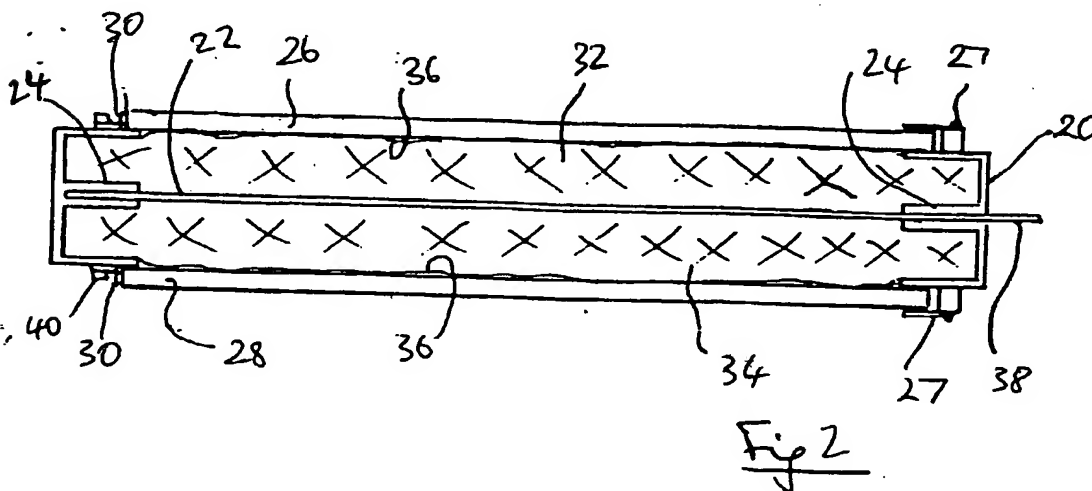
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(54) **Electrostatic air filter.**

(57) An electrostatic air filter has an insulating plastics frame (20) supporting an inner wire mesh screen (22), a pair of disposable fibreglass filter pads (32, 34) and a pair of outer wire mesh screens (26, 28) hinged to frame (20). The frame (20) supports the inner screen (22) so as to channel all the air flow through the filter through the inner screen (22). Co-extensive outer screens provide a more even electric field over the fibre pads (32, 34). The filter consequently can operate at nearer optimum efficiency with reduced leakage of the air flow through regions of the fibre pads (32, 34) exposed to a sub-optimum electric field. The inner screen may comprise a sheet of polyester impregnated with carbon.



EP 0 585 054 A1

This invention relates to a filter for filtering air of the type which includes an electrically conductive inner screen, a pair of electrically conductive outer screens locatable parallel to the inner screen, and a dielectric filter medium disposed between the inner screen and each of the outer screens.

In use, the filter is connected to an electrical power source with the outer screens held at ground potential and the inner screen held at a potential difference relative to the ground screens in the range 5-10 kV. The resultant electrostatic field polarises the filter media which attracts to the media any particles such as dust or smoke which are suspended in the air caused to flow through the filter. The efficiency of the filter is increased by this polarisation. Once the filter media are fully contaminated with particles they can be replaced.

An example of a known electrostatic air filter is disclosed in US patent 4,886,526 published on the 12th December 1989 and is illustrated at Figure 1. The filter comprises a filter cartridge 2 containing a pair of fibre dielectric filters 4 between which is sandwiched an inner screen 6. The filter pads 4 and screen 6 are contained within a cardboard container 8 having holes in the top and bottom surfaces to allow air to enter and flow through the filter. The container 8 is placed in a wire mesh frame whose sides form outer ground screens (not shown). The inner screen 6 is connectable to a high tension voltage source via an external electrical connector 10.

In use the ground screens are parallel to the inner screen and kept at ground potential whereby the filter pads 4 are polarised as described above.

It is an object of the invention to provide an improved filter.

According to the present invention an air filter for filtering air including an electrically conductive inner screen, a pair of electrically conductive outer screens locatable parallel to the inner screen and a dielectric filter medium disposed between the inner screen and each outer screens is characterised in that the inner screen is supported by a frame so as to channel all air passing through the filter through the inner screen.

Because the frame is configured so as to channel the air passing through the filter through the inner screen, the air will tend to flow in the region where there is an electrostatic field of the desired level with a very much reduced possibility of the air leaking around the side of the screen through filter material which is operating at less than optimum efficiency.

Preferably, the filter of the present invention is arranged so that the regions of the inner screen and outer screens adjacent the fibre media are substantially co-extensive. This structure provides that the electric field between the inner screen and outer screens is substantially constant over the whole of the dielectric medium. This allows the electrical po-

tential applied to the screens to be set at the most efficient level, which level will provide optimum efficiency, throughout the filter. This is in contrast to prior art electrostatic filters where field distortion at the ends of the filter reduces the efficiency of the filter in those regions.

The frame may be provided with recesses into which the edges of the filter media are removably insertable to retain the filter media in position adjacent the inner screen. With such an arrangement removable filter media may be used with the filter yet be retained in position during use. This allows the filter media to be replaced independently of the inner screen as they become contaminated as well as allowing access to the inner screen for cleaning thereby obviating the need to discard the inner screen once it becomes contaminated. A convenient arrangement for use with removable filter media is one in which the outer screens are each hinged to the frame so as to be movable between a first, closed position, parallel to the inner screen and a second, open position, to allow removal of one of the filter media. This allows each filter medium to be removed without scraping and possibly snagging the ground screens.

In preferred arrangements the filter includes latches for releasably retaining the outer screens in the closed position and a releasable retaining means for holding the outer screens in the open position for removal of the filter media.

The outer screens may be connected by an electrical conductor external to the frame to help ensure that they are at a common ground potential. This can be achieved, for example, by a metal band seated on the hinges of the ground screens in the embodiment where the ground screens are hinged for access to the filter media.

It will be appreciated that the present invention is also applicable to arrangements in which the inner screen, outer screens, and filter media are all formed into a single, disposable unit if it is not desired to replace the filters or clean the inner screen but rather to provide a readily replaceable cartridge-type unit for insertion into an air filter installation.

The filter media may include electrically conductive surfaces at least over the regions of the filter media in contact with the outer screen when in the closed position.

The frame may be of an extruded plastics material and can be provided with means for connecting the inner and outer screens to the electrical supply.

An embodiment of the present invention will now be described, by way of example only, and with reference to the accompanying drawings, of which:

Figure 1 is a sectional view of a prior art air filter; Figure 2 is a sectional view of an air filter in accordance with the present invention; and Figures 3 and 4 are a side view and a plan view, respectively, of the air filter of Figure 2 showing

means for holding the hinged outer screens in the open position.

The prior art filter of Figure 1 has already been described.

Referring now to Figures 2, 3 and 4 of the drawings, there is shown a filter in accordance with this invention comprising a plastics frame 20. The sides of the frame are E-shaped in section. An inner screen 22 of wire mesh is supported by central arms 24 of the plastics frame 20. A pair of outer screens 26, 28, also of wire mesh, are hinged to the opposite faces of the frame 20 by way of hinges 30. Latches 27 secure the outer screens 26 and 28 in the closed position. Filter media in the form of fibreglass filter pads 32, 34 fit between the respective outer wire mesh screens 26, 28 and the inner screen 22. The sides of the filter pads 26, 28 are coated with an electrically conductive coating 36.

An electrical terminal 38 is connected to the inner wire mesh screen 22. The outer mesh screens 26, 28 are connected to earth via a filter installation (not shown) into which the filter is insertable and to each other by a metal band 40. In use, an HT potential difference is applied between the inner screen 22 and outer wire mesh screens 26 and 28.

The filter operates in the same way as the prior art filter. However, because the thickness of the filter pads 21, 24 is uniform across the width of the screens producing the electric field, the operating potential of the filter can be optimised over the whole of the filter media 32, 34.

The production costs of the filter can be reduced because the inner wire mesh screen 22 does not have to be fabricated as part of a filter media-inner screen unit.

The cost of replacing the filter when it has become contaminated is reduced because only the two filter pads 32, 34 need to be replaced. The frame assembly can be removed from an installation so that the inner screen 22 can be washed.

Referring specifically to Figure 3, there is shown a locking arrangement 40 formed of like arms 42 and 44 pivotally joined to respective outer screens 26 and 28 at pivots 46 and 48 and to each other at the ends distant from the outer screens 26 and 28 at pivot 50 having a pivot pin 52 extending from the pivot 50 towards the frame 20.

The locked arms hold the outer screens 26 and 28 apart in the open position to allow removal of the filter media 32 and 34 with reduced chance of snagging the outer screens 26 and 28 by positioning the pivot pin 52 between a pair of ledges 54 protruding from the frame 20. It will be appreciated other means can be readily devised to hold the hinged outer screens 26, 28 in their open position.

The inner screen may be a sheet of polyester impregnated with carbon which can provide an electrically conductive screen whilst providing additional fil-

tering particularly effective at reducing odours in the air flow. Such sheets are readily available from a number of manufacturers, and simple trial and error will determine which grade provides an acceptable porosity to the air filter in a given air filter design.

## Claims

1. A filter for filtering air including an electrically conductive inner screen (20), a pair of electrically conductive outer screens (23, 28) locatable parallel to the inner screen (20) and a dielectric filter medium (21, 29) disposed between the inner screen (20) and each outer screens (23, 28) characterised in that:

the inner screen is supported by a frame (24) so as to channel all air passing through the filter through the inner screen.

2. A filter as claimed in claim 1 in which the regions of the inner screen (22) and outer screens (26, 28) adjacent the fibre media (32, 34) are substantially co-extensive.

3. A filter as claimed in either one of claims 1 and 2 in which the frame (20) has recesses into which the edges of filter media (32, 34) are removably insertable to retain the filter media (32, 34) in position adjacent the inner screen (20).

4. A filter as claimed in claim 3 in which the outer screens (26, 28) are each hinged to the frame (20) so as to be moveable between a first, closed position parallel to the inner screen (20) and a second, open position to allow removal of one of the filter media.

5. A filter as claimed in claim 4 and including latch means (27) for releasably retaining the outer screens (26, 28) in the closed position.

6. A filter as claimed in either one of claims 4 and 5 and including means for releasably retaining the outer screens in the open position.

7. A filter as claimed in any preceding claim in which the outer screens (26, 28) are electrically connected together by an electrical conductor (40) external to the frame (20).

8. A filter as claimed in any preceding claim in which this filter media (32, 34) include electrically conductive surfaces (36) at least over regions of the filter media (32, 34) in contact with the outer screens (26, 28) when in the closed position.

9. An air filter as claimed in any preceding claim in

which the inner screen comprises a sheet of polyester impregnated with carbon.

10. An air filter installation including a filter as claimed in any preceding claim and in which the filter is removable from the installation. 5

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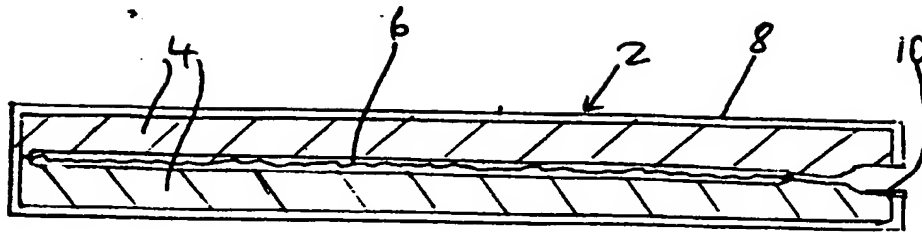
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PRIOR ART

Fig 1

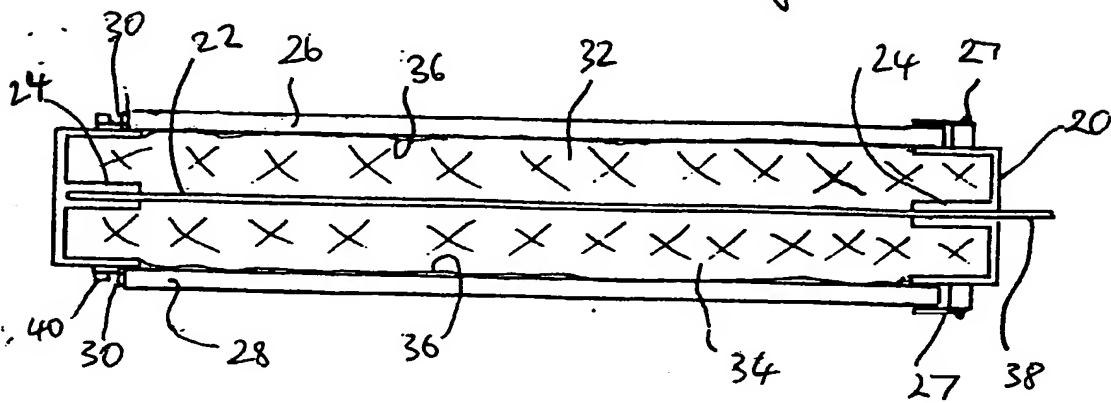


Fig 2

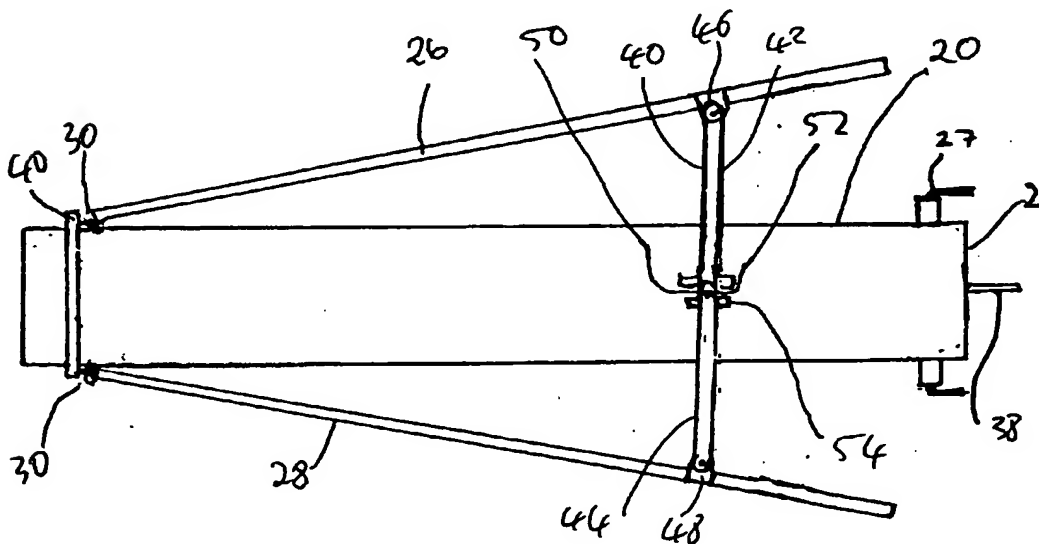
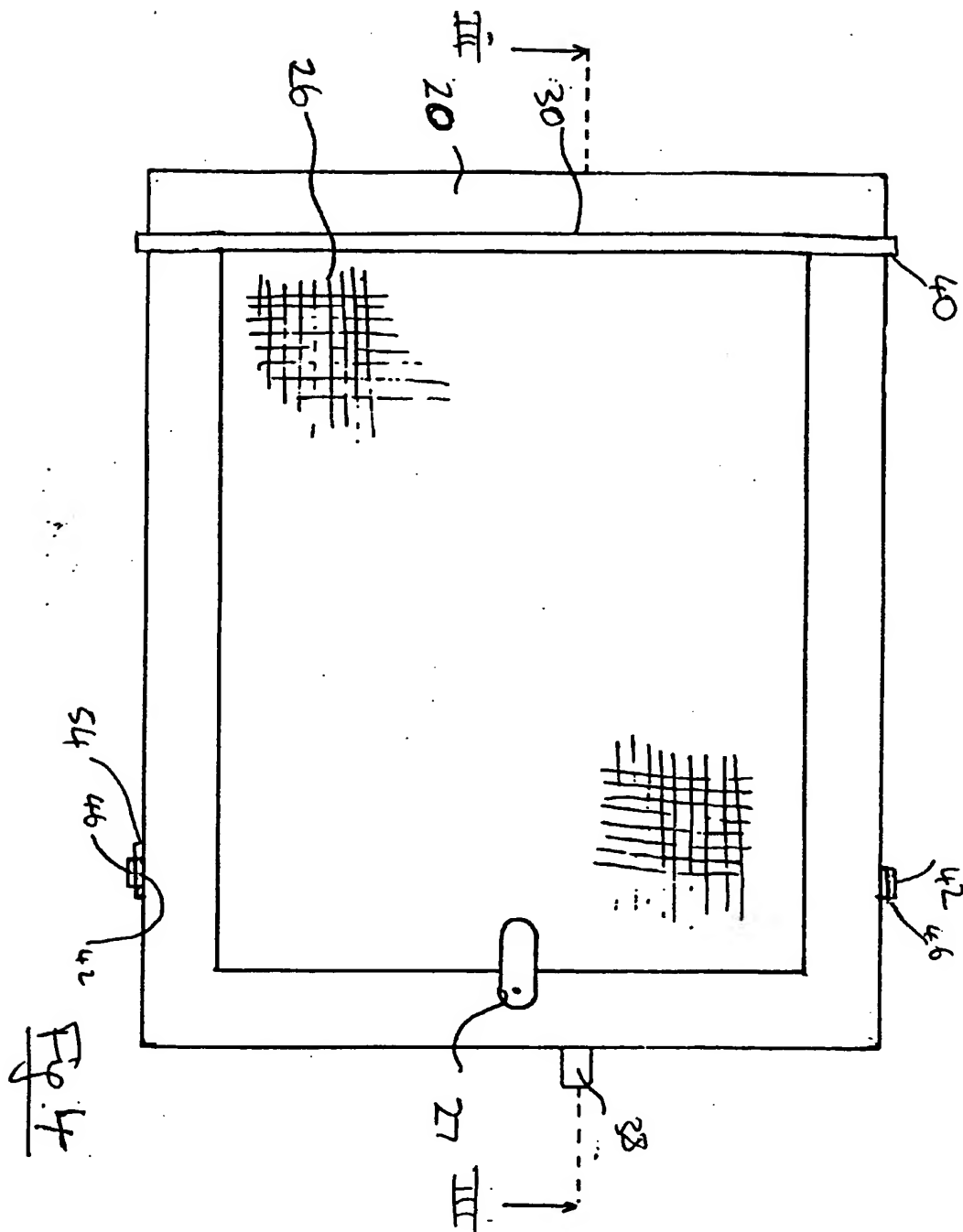


Fig 3





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## EUROPEAN SEARCH REPORT

Application Number

EP 93 30 6564

| DOCUMENTS CONSIDERED TO BE RELEVANT  |  |   |   |
|--|--|---|---|
| Category   | Citation of document with indication, where appropriate, of relevant passages                                    | Relevant to claim   | CLASSIFICATION OF THE APPLICATION (Int. CL.5) |
| X  | FR-A-2 124 215 (C.W.SOLTIS)<br>* page 2, line 23 - page 5, line 2; claims 1,5,7; figures 2,4 *                   | 1,2,7   | B03C3/14                                      |
| X<br>A   | WO-A-9 108 368 (W.E.PICK)<br>* page 7, line 12 - line 29 *<br>* page 8, line 14 - page 9, line 22; figures 4,8 * | 1,2<br>4,5,9  |   |
| X  | EP-A-0 229 857 (ENGINEERING DYNAMICS LTD)<br>* column 1, line 50 - column 2, line 23; figures 1,2 *              | 1-5,7,10  |   |
| A  | US-A-5 108 470 (W.PICK)<br>* claims 1,3,4; figures 1,9,11 *  | 1-7,9,10  |   |
|  |  |   | TECHNICAL FIELDS SEARCHED (Int. CL.5)         |
|  |  |   | B03C  |
| The present search report has been drawn up for all claims   |  |   |   |
| Place of search<br>THE HAGUE   |  | Date of completion of the search<br>20 OCTOBER 1993   | Examiner<br>DECANNIERE L.                     |
| CATEGORY OF CITED DOCUMENTS  |  | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>& : member of the same patent family, corresponding document |   |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category |  |   |   |

EPO FORM 1503 (01.82 (P0401))